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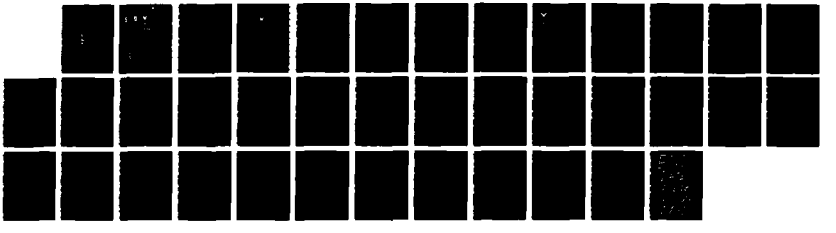

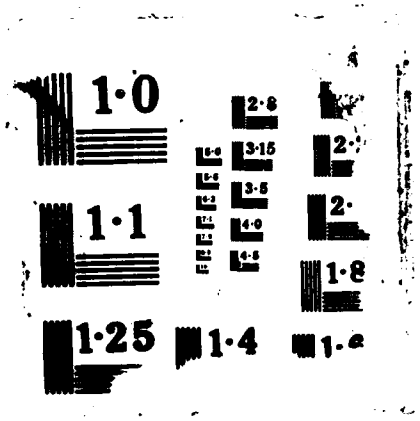
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STUDENT REPORT

Structure of a Professional Development Book for AF Communications-Computer Systems Officers

MAJ WILLIAM E. PARSONS 88-2055

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REPORT NUMBER 88-2055

TITLE STRUCTURE OF A PROFESSIONAL DEVELOPMENT BOOK FOR AF COMMUNICATIONS-COMPUTER SYSTEMS OFFICERS

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Submitted to the faculty in partial fulfillment of requirements for graduation.

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The 49XX career field is the largest non-rated officer career field in the Air Force. It is also one of the broadest in the Air Force in range of responsibility and types of jobs. This paper describes how a book could be structured to help the officers in this career field improve their technical skill. The paper concludes with some recommendations on developing such a book.

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PREFACE

From the results of a study directed by the Assistant Vice Chief of Staff, the Air Staff was informed on 4 November 1982 that the Chief of Staff had approved consolidating the management of communications and data automation. On 1 June 1983, the management of these two career fields were consolidated at HQ USAF. As of 30 April 1985, the two officer career fields were merged. The new 49XX career field consisted of around 7,000 officers with quite different backgrounds and a broad range of responsibilities. This paper tells how a book could be structured to help the officers in this new expanded career field improve their technical skill. The paper is being submitted to AF/SCBH and AUCPD/TM to assist them in making a decision on publishing a book for 49XX officers.

The author wishes to thank Lt Col Hoyt Warren (AF/SCBH) for sponsoring the project and Maj Del Tackett (AUCPD/TM) for providing guidance and reference material. This author sincerely hopes that this paper helps them publish a book for officers in the 49XX career field.

Finally, the author wishes to thank his family. His wife Reta, who typed the numerous drafts, was instrumental in the paper being finished. He also appreciates the support and understanding of his two children, Rachel and Paul, throughout the period of this study.

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ABOUT THE AUTHOR

Maj William E. Parsons entered the United States Air Force on 22 July 1965. While enlisted, he was in the flight simulator maintenance career field. During this period, he earned a BS in math from the University of Central Arkansas under the Bootstrap Commissioning Program. Upon commissioning in April 1973, he completed the Communications Systems Officer Course and was assigned to Charleston AFB, SC as Chief of Operations in the 1968th Communications Squadron. While at Charleston AFB, he completed a master's degree in Management and Supervision from the University of Central Michigan and Squadron Officers School by correspondence. In February 1976, he was assigned to 2146th Communications Group as Chief of Voice Operations. He was selected in December 1976 as the Outstanding Junior Officer of the Quarter for all AFCC units worldwide. After this one year remote assignment, he was assigned to Headquarters European Communications Area at Kapaun AS GE, as an Exercise and Plans Officer. During this period, he attended Squadron Officers School in residence where he graduated in the top one-third. From Germany, he attended the Telecommunications System Staff Course at Keesler AFB, MS. Upon graduation, he was assigned to HQ USAF, Assistant Chief of Staff/Intelligence, as Chief, Intelligence Communications Integration Section. While at HQ USAF, he completed Air Command and Staff College by correspondence and was selected by the Armed Forces Communications and Electronics Association as AFCEAN of the Month for April 1982. In April 1984, he was assigned to the Air Force Military Personnel Center at Randolph AFB, TX as an assignments officer in the Colonels' Group. During this period, he completed Air War College by correspondence and earned 30 semester hours with Wesbter University toward a second master's degree in Computer Resource Management. In August 1987, he was assigned to Air Command and Staff College, Maxwell AFB, AL as a student.

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EXECUTIVE SUMMARY

Part of our College mission is distribution of the students' problem solving products to DOD sponsors and other interested agencies to enhance insight into contemporary, defense related issues. While the College has accepted this product as meeting academic requirements for graduation, the views and opinions expressed or implied are solely those of the author and should not be construed as carrying official sanction.

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REPORT NUMBER 88-2055

AUTHOR(S) MAJOR WILLIAM E. PARSONS, USAF

TITLE STRUCTURE OF A PROFESSIONAL DEVELOPMENT BOOK FOR AF COMMUNICATIONS-COMPUTER SYSTEMS OFFICERS

I. Purpose: To describe how to structure a book which can help communications-computer systems officers improve their technical skill.

II. Problem: When the communications (30XX) and computer (51XX) career fields were merged into the 49XX career field in 1985, the new career field consisted of over 7,000 officers with diverse backgrounds. Their new career field is the largest non-rated officer career field in the Air Force, and it has one of the broadest areas of responsibilities. The officers can obtain professional development through USAF formal schools, master's programs, courses/seminars/symposiums, and professional readings. None of these methods provide one source to obtain the bottom lines about the career field. A book written for 49XX officers could fill this void.

III. Data: Books, magazines, AU and ATC course material, AU student research reports, and discussions with personnel responsible for training 49XX officers were used to prepare

this paper. The books provided the formats that are being used to educate a generic communications-computer professional. But this is not the purpose of this book. It is intended for a specific reader--the 49XX officer. Magazines, especially the Air Force Magazine and SIGNAL, help provide this focus. The AU and ATC course material will prevent a duplication of effort by the authors of the book. These materials make excellent reference materials for the officers who need additional information. Many of the communications-computer topics had already been researched by AU students. The conclusions in these reports can be integrated into the book. This will provide valuable information and save space. The material provided by AU and ATC personnel were especially valuable. It provided the insight into what is being taught to 49XX officers.

IV. Conclusion: The book should integrate the best features of books, magazine articles, ATC 49XX course material, and other related communications-computer material to develop a concise book especially written for 49XX officers. The authors should limit the size to one volume and keep it unclassified.

V. Recommendation: The book should be easy for the 49XX officers to use. It should contain figures, charts, and graphs to reduce detailed explanation and be organized by unified, specified and MAJCOMs for certain topics. The material on topics should be proportional to the amount of present and future applicability. Since the size of the book will limit the amount of information that can be included, relevant material must be referenced in appropriate topics for those officers who might need more information. In determining which topics to emphasize, the authors should consider the political, military, and economic environments. This approach should identify the most important communications-computer topics for 49XX officers.

Chapter One

INTRODUCTION

> The communications-computer systems career field is one of the broadest in the Air Force in range of responsibility, levels and location of assignments, and types of jobs. Most importantly, it is a functional area that impacts virtually every other operational or support function in the Air Force--one without which the Air Force could not conduct its wartime or peacetime mission (38:1).

The above quote from the Communications-Computer Systems Officer Career Development Guide describes the scope and importance of this career field. The guide also states, "You can expect to hold an incredible variety of assignments at all levels of responsibility during your career" (38:3). This would include remote/overseas assignments to CONUS, large computer centers to small antiquated communications systems, commanders of small communications detachments to Joint Chief of Staff positions, jobs in various MAJCOMs, and even career broadening. According to the functional manager for the career field, Brig Gen Robert H. Ludwig, the computer explosion over the last five years is causing significant changes in the Air Force's fundamental work processes (18:48). These changes and the broad scope of the career field make it critical that these officers have the means to build their technical skills. This paper will describe how to structure a book which can help Air Force communications-computer systems officers improve technical skill.

EXISTING PROFESSIONAL DEVELOPMENT

The Air Force strongly supports professional development of the officers in the communications-computer systems career field. When Maj Gen John T. Stihl was functional manager of the career field, he stated that the Air Force has a goal to improve the capabilities of their professionals through education and training (24:95). This section will discuss the USAF formal schools, master's programs, courses/seminars/ symposiums, and professional reading available to the communications-computer systems officer.

The Air Force provides a strong basic technical foundation for its officers in the communications-computer systems career field. There are 42 formal 49XX education courses taught by Air Training Command (ATC) at Keesler AFB, MS; Reston, VA; Peterson AFB, CO; Lowry AFB, CO; and Lackland AFB, TX (39:3-60 - 3-65). Some of these courses are taught at mobile and host sites. The 42 courses range in length from a 1-day Software Quality Orientation for Executives to a 207-day Communications-Computer Systems Staff Officer Course for captains through lieutenant colonels. In addition to these ATC courses, Air University (AU) offers several courses for 49XX officers at Maxwell AFB, AL and some Air Force Institute of Technology (AFIT) courses at Wright-Patterson AFB, OH (39:4-35,4-36,4-59,4-60,4-61).

A second method of career development is a master's degree in telecommunications or computers. Programs at AFIT include degrees in computer systems (39:4-42). There are also programs offered by civilian universities such as Webster University.

Short technical education courses lasting two to five days are another way for communications-computer systems officers to obtain professional development. The Armed Forces Communications and Electronics Association (AFCEA) seminars are the most reasonably priced for military/government employees at $120.00. These courses are presented in the Washington, DC area and California (24:95). They cover such topics as artificial intelligence, communications security, military uses of high frequency (HF) spectrum, and principles of computer security (27:94). There are also symposiums/conferences around the world on communications-computer topics (26:--).

A fourth method of career development is magazines and newspapers on communications and computers. Some of these require paid subscriptions while others are free. SIGNAL magazine, an excellent source of information, costs $27 for a one-year subscription, but many periodicals are free to 49XX officers. These include INTERCOM, InformationWEEK, PC WEEK, Government Computer News, and CommunicationsWeek just to name a few.

Thus, a 49XX officer's career can be enhanced by formal Air Force schools, master's programs, courses/seminars/symposiums, and professional readings. Each of these methods offers professional development for 49XX officers in telecommunications, computers, or a combination of the two. The 49XX officers will receive both telecommunication and computer training in the 49X1 course that provides training for the basic skills and knowledges to perform as communications-computer systems officer (39:3-64). After this beginning course, the officers will be assigned to jobs that may be

almost totally computer oriented, totally telecommunications oriented, or some combination of communications and computer related duties. The 49XX officers will focus on the professional development that will help them do a better Air Force job. Therefore, some 49XX officers will have more expertise and training in computers while others have more in telecommunications. The authors need to take this into consideration when developing the book.

PURPOSE OF THIS BOOK

This book is not intended to replace any of the professional development methods described in the previous section. The author of this paper believes that the book should be made available to every communications-computer systems officer. They should use the book to supplement USAF formal schools, master's programs, courses/seminars/symposiums. and professional reading.

Most 49XX USAF formal schools are designed for a particular phase of a 49XX officer's career. For example, the Communications-Computer Systems Operations Officer Course (E3OBR4941A) provides training for basic skills and knowledge in the 4941 career field while the Communications-Computer Systems Executive Seminar provides a current corporate perspective of command, control, communications, and computer system management. The former is intended for officers entering the career field while the latter is for lieutenant colonels and colonels whose duties are directly related to communications-computer systems management (39:4-35,4-36). The book should be structured so it is useful to all 49XX graduates of USAF formal schools.

The book should also be structured so it is useful to those officers who have completed a master's program in a 49XX related area. For these officers, the book should relate what they have learned in graduate programs to Air Force communications-computer systems. This means that some portion of the book may be fairly technical. The book would also be beneficial to officers taking short courses, seminars, and symposiums. These professional development programs usually target a small portion of the career field. The officers could read that portion of the book before attending the course, seminar, or symposium. This would provide a basic review and a better understanding of how it relates to Air Force systems.

When a 49XX officer reads a newspaper or magazine on an unfamiliar communications-computer topic, the book can be used to understand the unknown and relate it to Air Force systems.

This means the book should be up-to-date regarding Air Force communications-computer systems.

In summary, the book would be a reference book for Air Force communications-computer systems officers. It should contain an appendix with a list of relevant 49XX USAF formal schools; master's programs; organizations offering short courses, seminars, and symposiums; newspapers; and magazines. The communications-computer systems officers need one book that has the bottom lines. The book is described in Chapters Two, Three, and Four of this research paper.

OVERVIEW

This chapter has introduced existing professional development for communications-computer systems officers and the purpose of the book. The remaining portion will focus on the structure of the book.

Specifically, Chapter Two will describe the level and type of information that should be included on computers. The chapter will be divided into hardware and software.

Chapter Three is similiar to Chapter Two but addresses communications. This chapter is divided into basic technical communications information and transmission media.

Chapter Four uses the information in the previous two chapters to explain what should be discussed on communications-computer systems. While Chapters Two and Three are basically technical in nature, this chapter ties communications-computer technology to systems used by the Air Force.

The final chapter contains recommendations. It could be considered an executive summary of Chapters Two, Three, and Four. In other words, it is the bottom lines.

The appendix contains an outline of how the book should be structured. Since this paper is organized in the same way as the book should be structured, the outline is also an overview of this paper.

Chapter Two

COMPUTERS

> Indeed, much of our modern communications is possible only because computer processors are embedded in our switching and transmission hardware. On the other side of the coin, much of our modern automation is made possible by our ability to communicate data and results between our automatic data processing centers (23:34).

The above quote by Maj Gen Gerald L. Prather, former functional manager for the communications-computer systems career field, points out how computers have become an integral part of Air Force communication systems and the communications-computer systems career field. This chapter will discuss what information about hardware and software should be included in the book.

HARDWARE

In a recent survey conducted by Brig Gen Ludwig, he discovered that the Air Force has fielded or funded more than 100,000 general purpose computer terminals (18:48). This is approximately one for every eight people in the Air Force. With the communications-computer systems officer being involved with every phase of installation and operation of computers, the book needs to cover a variety of topics. These include an introduction to computers, components, micros, supermicros, minicomputers, mainframes, supercomputers, and issues (49:--).

The introduction, as well as all other parts, should not be a textbook explanation. It should relate thoses changes in computers to the Air Force. The explanation should describe how the Air Force changed from one generation computer to another. Was it successful? Was it done at the right time? These are the questions that Air Force communications-computer systems officers need to know. Closely tying each section of the book to the unique Air Force situations is what will make the book valuable. The introduction to the chapter on computers must also contain basic explanations and operations that will be required to understand the rest of this chapter.

Components of computers must also be discussed. These would include the central processing unit (CPU), storage devices, and input/output devices. The CPU part of the book could include the control section, arithmetic section, logic unit, and internal memory to include read-only memory, random access memory, programmable read-only memory, and erasable programmable read-only memory. The discussion on storage devices could include floppies, hard disk, optical disk, cassettes, tape cartridges, drums, and magnetic tapes (49:--). The list of items to be discussed in the CPU and storage devices sections alone is extensive. This points out another method that must be used in developing the book. For each section, the authors must make extensive use of graphs, charts, pictures, and figures to convey the information in minimum space with minimum explanation. With a basic understanding of the components, the reader will be ready for micros.

Micros will be one of the most important sections to the communications-computer systems officer because so many people in the Air Force will be "knowledgeable" about these terminals. The Air Force users will be asking questions about these terminals, and it is important that the 49XX officers be able to answer the questions to maintain credibility. This points out another important principle to follow in deciding what information to include in the book. It should contain information that will help the 49XX officer answer common questions asked by the user.

Supermicros are difficult to define. As a matter of fact, there is no agreement on exactly what combination of characteristics define a supercomputer (7:229). These computers are built around today's microprocessors and hold a strong performance edge over traditional microcomputers. This section should give the 49XX officer an understanding of how supermicroprocessors will be used in the Air Force.

The minicomputer can be defined as a small general purpose computer that costs $2,500 to $75,000 (7:232). This price makes it cost effective for Air Force organizations to use the minicomputers for distributed data processing. This section should convey how extensively the Air Force is using the minicomputer and address the future of the minicomputer in Air Force organizations. Specifically, it should answer if the minicomputer will be able to replace mainframes.

Mainframes can cost $20,000 to $5,000,000 (7:208). In the 1970s, over half of all mainframes installed were IBM System/370 machines (7:237). This section should contain information on what mainframes are being installed today and compare this data to what the Air Force is buying and why. Then, the section should focus on explaining how these

mainframes meet the Air Force mission. It should discuss if these organizations need more computing power.

The supercomputer is needed for some Air Force organizations as the problems increase to a point that mainframes cannot satisfy. The book should address the Air Force applications such as command, control, communications and intelligence (C3I) that require a computer larger than a mainframe. It should outline which organizations have them now and which ones will need them in the future. Since only a minimum of the 49XX officers will be involved with supercomputers, this section can be brief.

The hardware portion of the book should be closed out with a discussion on the hardware issues. These include such issues as maintenance, modifications, proliferation of micros, and short technology cycle. Some of the major issues in the Air Force could be provided by the HQ Standard Systems Center. Their mission is to design, acquire, produce, and manage standard automated systems to support the Air Force mission during peace, crisis, and conflict (43:5). Their mission makes them aware of the computer issues in today's Air Force. This is an important point for not only this section of the book but others as well. The authors should consult all Air Force organizations that can contribute information to the book.

SOFTWARE

Software expenditures for the Air Force will increase from $3 billion to $30 billion by 1990 (19:100). The book needs to address those topics that will help the communications-computer officers spend the money wisely. These areas include an introduction to software, computer languages, applications software, systems software, software development, commercial software, and issues (49:--).

The introduction to software should contain background information, terminology, and basic operation for computer software. For background information, one good source is "The Software Crisis and a Senior Leaders Awareness Course." This Air Command and Staff College (ACSC) research project completed last year reviews the literature and highlights the problems in software development (47:1). The section on basic terminology should not be textbook definitions but definitions that relate the terms to Air Force computer systems. Basic operation of computer software must explain, for example, what happens when a computer boots up. These explanations of basic computer operations can get lengthy but need to be kept short. Graphs, charts, pictures, and figures can be very effective. With a

background in software terminology and an understanding of basic computer operations, the reader is ready for a section on computer languages.

The Air Force uses most computer languages. Thus, this section should make a comparison of the computer languages used by Air Force organizations. The time and space devoted to each language should be directly porportional to the degree it is used or will be used by the Air Force. Ada is a multipurpose language developed by the U.S. Department of Defense (DoD) (3:262). Per the Deputy Chief of Staff for Information Management, US Army Information Systems Command, "It is predicted that Ada will be the most important programming language of the 1980's and 1990's and the last new language prior to automatic programming" (17:148). For these reasons, the authors of the book should devote more time and space contrasting its capabilities and limitations with other computer languages.

The section on systems software is very important to the 49XX officers. It provides an understanding of the software that operates the computer. For mini and mainframe operating system software, the choice depends on the processing orientation of the particular Air Force organization. As stated in Introduction to Computers and Information Processing, "Some operating systems (for mini and mainframe hardware) are better for timesharing, others for batch processing, and others for distributed data processing" (3:271). For personal computers, CP/M-80 has become one of the most popular operating systems. In contrast, MS-DOS and UNIX are being used in most 16-bit microcomputers (7:335). The book should explain the capabilities and limitations of these operating systems as they apply to Air Force systems.

Application software is similar to microprocessors in that the users will have a lot of questions for 49XX officers about this software. Air Force organizations depend heavily on wordprocessing, spreadsheets, data base management, graphics, and other types of applications programs. Magazines and newspapers often have in-depth analysis including charts that compare the best current application software on the market. For example, the 17 November 1987 issue of PC Week compares word processing software with macro capabilities. It uses features such as minimum memory, maximum dictionary size, accepts ASCII, and command/menu driven (28:--). This portion of the book needs to provide an understanding of the features usually evaluated for each type of application software. There are two ways the Air Force can obtain application software. The first method discussed will be software development.

Software development is accomplished by several Air Force organizations. One of the primary organizations is the Standard Systems Center which develops 10,000,000 lines of code per year (43:7). Another organization is the Air Force Wargaming Center which develops its own lines of code for AU academic exercises. The book should provide a summary of who develops code in the Air Force and why they develop it as opposed to the second method of obtaining commercial software.

Commercial software can be an excellent alternative to software development. But as pointed out in SIGNAL magazine, "...software acquisition (in DOD) proves to be the major weakness in project management" (13:76). The book should provide historical data on what has worked out best for past Air Force programs concerning in-house development or buying off-the-shelf/commercial developed software. These evaluations should take into consideration that software development both in-house and commercial is changing rapidly. A past decision to develop certain software within the Air Force may not be the best decision for future acquisitions. The section should also reference some books such as Software Project Management (6:--) for those officers that are more involved with acquisitions of software.

The last section of the software portion should discuss issues. These could include security, training, and standardization. Security is a major problem with DoD automated systems (16:179). The Air Force needs computers that have software protection to allow for simultaneously processing a range of sensitive or classified information. The book should discuss what problems a 49XX officer needs to know in this area. Training is another issue in the dynamic world of software development. What does the 49XX officer need to know about training for Air Foce issues of computer systems? The last issue that should be included is standardization. With the growing need to connect Air Force systems intra and inter base, standardization is a critical and sensitive issue. Since some of these software issues could also be hardware issues, the authors should consider addressing all issues in one section. The next chapter discusses the connection of Air Force computer systems.

Chapter Three

COMMUNICATIONS

"The President can make you a general, but only communications can make you a commander" (38:1). General Curtis Lemay clearly recognized the importance of commanders being able to communicate with subordinates. Today's Air Force leaders use a far more sophisticated communications system than the ones available during General Lemay's day. The Air Force communication systems today consist of satellites and optical fibers that were not even being used a few years ago. Before discussing what should be included on transmission media, it is important to understand what should be included to provide a basic understanding of communications.

BASIC TECHNICAL COMMUNICATIONS INFORMATION

This section will identify information that is not necessarily unique to Air Force communications. It will identify generic communications information that every communications-computer systems officer needs to know. These topics are time/frequency/bandwidth relationships, coding, modulation, multiplexing, difference between analog and digital, protocols, switching, security, and error control (49:--).

Time, frequency, and bandwidth relations is a complicated topic. An entire book could be written on this topic but this is not necessary as 49XX officers receive training on these topics in 49XX AIC courses. Therefore, a quick review of the basics such as accomplished in Chapter One of Telecommunications and Networking is adequate (5:19-25). For the 49XX officer who does need more of a review, this portion of the book should reference the study guides prepared by 3390 Technical Training Group (TTG), Keesler AFB, MS that will provide more detailed information. It should also integrate the materials prepared for 49XX AIC courses.

A book for 49XX officers must address error control, but the authors must be careful not to be too technical or lengthy. An approach like the one in Data Communications, Networks, and

Systems can be a good format to use (1:289-352). It explains the difference between source encoding/decoding and channel encoding/decoding. Then, it lists some fundamental concepts of coding, discusses coding approaches and characteristics, describes channel characterizations, and explains coding limits. This gives the 49XX officer a foundation in coding/error control.

There are distinct advantages and disadvantages in various modulation techniques in terms of cost and noise susceptibility (5:62). This portion of the book should begin with a basic description of amplitude, frequency, phase, and pulse modulation. This section should act as a refresher for 49XX officers with a communications background but provide more of a review for 49XX officers with a computer background who may not have as much training in this area. To save space, the authors could use the type of figures in Chapter 11 of Telecommunications and Computers (4:203-228). These color figures make it easier to grasp concepts than black and white.

Multiplexing is another subject that most 49XX officers are taught in USAF schools. This portion of the book needs to be direct and to the point. A good example is contained in Telecommunications and Networking.

> Multiplexing is a technique whereby a number of independently generated signals can be combined and transmitted on a single physical circuit. The justification for the use of multiplexing is more effective utilization of system resources. Multiplexing is usually divided into two categories, time multiplexing and frequency multiplexing (5:63).

The above description of multiplexing does not waste space. In contrast, figures such as 12.3 in Telecommunications and Computers do not explain multiplexing enough to justify two full pages (4:234-235).

To effectively manage a communications system, the 49XX officer needs to understand the differences between analog and digital transmissions. There are definite advantages and disadvantages concerning bandwidth and data rates for each of the two types of transmissions. This portion of the book could take advantage of the materials prepared by the 3390 ITG. Student Text KIS 4911-510A, Principles and Concepts of Analog Communications Theory, and Handout KIS 4911-510E, Selected Readings in Analog and Digital Theory, provide extensive details on both analog and digital transmissions (34:--; 31:--). The 3390 ITG has done an excellent job of preparing these materials, but they are too lengthy and technical for this book. These and

any other material related to this topic should be referenced in this portion of the book. The information put in the book should look like an executive summary of the information prepared by the 3390 ITG.

To explain protocols, the authors should use an approach such as contained in Data Communications, Networks, and Systems. It gives an introduction that tells what a protocol is, describes its basic functions, and explains some basic terms. Next, it leads the reader through choosing subnetwork protocols. It concludes with some examples of protocols (1:119-137). The example approach is also used in Telecommunications and Networking and A Practical Guide to Computer Communications and Networking (5:296-324; 2:88-103). In addition to providing a basic understanding of protocols, this section needs to address future protocols such as the Open Systems Interconnect (OSI). Although the Defense Digital Network (DDN) is currently using the telecommunications protocol/internet protocol (TCP/IP), it is scheduled to be changed to OSI protocol in 1990 (8:115).

The approach used in Telecommunications and Networking to explain switching would be excellent for this book. It used networks such as TYMNET, CYBERNET, and ARPANET to describe the switching techniques (5:222-237). For the book for 49XX officers, the authors should use a similar approach but use Air Force networks. Figures such as 8.3 and 8.5 in Telcommunications and Networking can be used to describe the format for message switching networks and packet switching networks, respectively. Also figures such as 8.7 allow the reader to quickly grasp the geographical configuration of the switches for particular networks. These types of figures should be used to maximize the information in minimum space. Another excellent source is Student Text KIS 4911-5568 prepared by the 3390 ITG. It contains detailed information on switching center support equipment, manual switching systems, progressive control switching systems, and common control switching systems (36:i).

Computer security will be one of the most important sections in the book. The authors should use a combination of explanation and checklist for the section. The 49XX officers know why security is needed so this section should concentrate on the threats to the telecommunications systems and how to make the systems more secure. In Data Communications, Networks, and Systems, Mr Stephen T. Walker has an entire chapter on computer and communications security (1:237-262). Results of AU reports such as the ACSC Report 87-0935 done by Maj James D. Gatewood on "Standard Base Level Computer System Access" should also be included (42:--). From these types of sources, checklists can be developed to block the threats. Due to the blurring of distinctions between communications and computers, Mr Donald C. Latham, Assistant Secretary of Defense for C3I has merged

Communications Security (COMSEC) and Computer Security (COMPUSEC) into one office (16:180). This approach would also be good for this book. Security could be better addressed if done in one location rather than split between communications and computers.

TRANSMISSION MEDIA

This section also contains generic information about communications. The transmission media topics discussed in Data Communications, Networks, and Systems and Telecommunications and Networking are the appropriate topics for this section of the book (1:Ch 1; 5:Ch 5). Thus, it discusses what should be included in the book on paired cable, coaxial cable, waveguides, optical fibers, and radio propagation.

Multipair cable is used in the telephone network for wiring within Air Force buildings, between the buildings and dial central office (DCO), and between the DCO and the switching centers off base (1:19). The extensive use of multipair cable makes it important for the 49XX officer to understand its advantages and disadvantages. The area that should be emphasized is data rate verses distance on various guage cable. For example, with 22 guage cable 1.5 Mb/s can be transmitted 2 Km without repeaters. If the data rate is lowered to 2.4 Kb/s, it can be transmitted over 20 Km. In Data Communications, Networks, and Systems, Figure 1-1 graphically shows this relationship for 26, 24, and 22 guage cable in minimum space (1:20).

The coaxial cable, a single-wire conductor centered within a cylindrical outer conductor or shield, has a number of important advantages as a transmission media. This section should focus on its principal advantage, wide bandwidth (1:23). This characteristic gives it the capability to carry large numbers of voice conversations, high speed data, and a large number of video transmissions. A picture of three typical coaxial cables (rigid air dielectric, flexible solid dielectric, and flexible air dielectric) such as the one contained in 3390 ITG Handout KIS 4911-508A should be used (30:20).

The section on waveguides should focus on its limitations. One of the main limitations is distance. It has not been used for long distance communications like paired and coaxial cable. The 3390 ITG Handout KIS 4911-508A also has some characteristics and advantages/disadvantages of waveguides (30:22-28). This author does not see the section on waveguides to be very extensive.

In comparison, the section on optical fibers needs to be much more extensive. Per 3390 ITG Student Text KIS 4911-530A, "Today the telecommunications industry stands on the threshold of a new communications concept-the transmission of information by the use of light" (35:1). The student text also states that optical fibers are rapidly expanding military applications. The features that make it attractive for military application are larger bandwidths, freedom from crosstalk, and light weight (35:23). As indicated in Figure 31 of Student Text KIS 4911-530A, the cost of 26 pair fiber cable became cheaper than 26 pair conventional cable in 1975. For these reasons, the 49XX officers need to understand the current and future capabilities of optical fibers. As with other communications-computer topics discussed, there is an AU report on fiber optics. Mr Jerry W. Tipps' ACSC report concludes, "Fiber-optic-based data communications systems are commercially available and can be provided by a number of turn-key vendors" (48:X). His report develops a technical specification for the Arnold Engineering Development Center and then evaluates proposals submitted by contractors.

Telecommunications and Networking contains the proper level of details on radio transmission media. It contains Table 5-4, the radio spectrum, at the beginning of the section. This table contains the frequency band 3 KHz-300 GHz, name of the band (e.g. Very Low Frequency (VLF)), microwave band (GHz), letter designation, and typical uses. The table conveys a great deal of information in minimum space (5:155). The 3390 ITG Handout KIS 4911-508A and 520B also has some very useful figures that should be used in the section on radio transmission (30:29-209; 32:--). But this section needs more than the fundamentals of radio transmission media. It needs to discuss improvements being made in this media (15:91). In HF communications, the reliability has been improved with adaptive techniques. These include in-band frequency agility, modulation, coding, and interleaving (15:92). HF could also be used in conjunction with satellites to combine the advantages of both systems to create a synergistic effect. The Air Force is also making improvements in Ultra High Frequency (UHF) by retrofitting the terminals with frequency hopping capabilities (15:92). These and any other improvements or innovations in radio transmissions need to be explained in this section. AU research projects can also be helpful in this area. For example, Major Robert D. Brown's 1987 ACSC Report 87-0370 can be used to obtain information on tactical satellite communications (41:--).

Chapters Two and Three have outlined a great deal of information that must be included in the book. The next chapter will build on this information by discussing communications-computer systems.

Chapter Four

SYSTEMS

The technological advances in communications and computers have made the individual pieces of equipment more complex. These items which were discussed in Chapters Two and Three are used to form systems to get information from the source to the destination. As these systems become more complex, it is imperative that the communications-computer systems officers understand the system and not just the parts. As pointed out in Maj Abel's 1987 ACSC research project, "Numerous downward-directed information systems programs and beddown of major weapon systems generate extraordinary information systems expansions and upgrades" (40:vi). Thus, the chapter will look at the seven types of communications-computer systems that support an Air Force base. These include functional standard systems, MAJCOM unique systems, common user systems, weapon system embedded systems, joint systems, combined systems, and black program systems (25:70).

FUNCTIONAL STANDARD SYSTEMS

The functional standard systems include the ones from Air Force Communications Command's (AFCC) Standard Systems Center or a functional area (25:70). The Standard Systems Center effort is a result of over 2200 people and $200M operations and maintenance (O&M) funds each year. The acquisition program management includes over 70 programs and 1200 contracts. Their software productions consists of 1263 people, who write 10,000,000 lines of code for 8,108 programs to support 137 systems (43:7).

The functional areas would include engineering/services, personnel, comptroller, supply, transportation, contracting, hospital, security police, miscellaneous support systems (i.e. Office of Special Investigation (OSI), Administration, Judge Advocate General (JAG), Chaplain, Commissary, Operations, Weather, and Maintenance) (45:17-26). ACSC Report 84-2175 contains a general description, current information flow, deficiencies, and planned improvements for the network requirements in each of the functional areas. Although the

authors would have to update the information contained in the 1984 report, this would be a good format for them to use.

The authors will not have the space to provide a detailed explanation of all of these systems. A similar problem exists at AU on deciding which areas should be included in their professional military education (PME) programs. One of the factors that influenced their decision is the background of the student. Very few of today's ACSC students have combat experience as compared with 70 percent with combat experience in 1977. Therefore, 40 percent of the ACSC curriculum now consists of military history and theory, low-intensity-conflict studies, and general war studies (21:62). AU has also adjusted the ACSC curriculum because of the changing needs of the Air Force. For example, space operations has grown from a two hour block in 1977 to 42 hours in 1987 (21:63). The Air Force Military Personnel Center could provide information on the background of 49XX officers to help the authors make decisions on what information to include.

MAJCOM UNIQUE SYSTEMS

There are numerous MAJCOM unique communications-computer systems that make up the second type. For the Tactical Air Command (TAC), these include the Airborne Warning and Control System (AWACS), Tactical Air Control System (TACS), and Regional Operational Control Centers. It also has special purpose computer systems to support the USAF Tactical Fighter Weapons, Tactical Air Warfare, and Air Defense Weapons Centers (46:50). The Military Airlift Command (MAC) uses the Consolidated Aerial Port System (CAPS) to track passengers and cargo (45:11). The Strategic Air Command Digital Information Network (SACDIN), a SAC unique communications-computer system, is made up of 500,000 lines of code. One fifth of this code has unimpeachable security and integrity (10:49). There are many more MAJCOM unique communications-computer systems in these commands as well as the other MAJCOMs. To cover this area, the authors should discuss these systems by MAJCOM in terms of components, capabilities, and projected improvements.

COMMON USER SYSTEMS

The third type, common user systems, includes such systems as Automatic Voice Network (AUTOVON) and Automatic Digital Networks (AUTODIN). On 10 March 1983, a directive from the Secretary of Defense significantly increased the importance of the Digital Data Network (DDN), a common user system.

> All DOD ADP systems and data networks requiring data communications services will be provided long haul

and area communications, interconnectivity, and the capability for interoperability by the (Digital Data Network) DDN. Existing systems, systems being expanded or upgraded, and new ADP systems or all such systems must be registered in the DDN's User Requirements Data Base (URDB) (44:4).

With this emphasis on DDN, the common user portion of the book should emphasize DDN. It should discuss DDN exemption categories, current DDN mode installation status, contain figures on DDN in CONUS/Pacific/Europe, and planned enhancement of DDN.

WEAPON SYSTEM EMBEDDED SYSTEMS

The fourth type of communications-computer systems is the weapon system embedded systems. In an interview with General John T. Chain, Commander-in-Chief SAC, in the August 1987 issue of Air Force Magazine, General Chain explained how he felt the Peacekeeper rail garrison concept would work. In time of hostilities, the train would be moved somewhere on 200,000 miles of railroad track in the United States (11:30-31). Although General Chain believes the American people will support the rail garrison concept, it may not be the concept used to deploy Peacekeeper. Thus, the authors should put only funded communications-computer systems in the book.

In the same article, General Chain makes two other points about the communications-computer systems in support of SAC weapon systems. He makes the point that the cost of initial development of new systems should be kept to a minimum. One way is to obtain trade off information between cost and performance of the systems. Another method suggested by General Chain is to make the greatest use of off-the-shelf components (11:31). With the projected budget cuts, it is critical that the authors address these areas in the book to help the 49XX officers keep the cost down on communications-computer weapon systems embedded systems.

JOINT SYSTEMS

Joint systems is the fifth type of systems the authors should discuss. These would include such US systems as the Military Strategic Tactical and Relay Satellite Communications (MILSTAR) system. This satellite system will have some 2,000 terminals to provide mission essential communications between aircraft, ships, mobile ground terminals, and key command and control centers (22:27). Even the newest unified command (USTRANSCOM), is busy developing joint communications-computer systems. Per

USTRANSCOM's Chief of Staff, Col David S. Hinton, "If we do nothing more than pull off the consolidation of ADP efforts under one command, we will have justified our existance and have saved the American taxpayers untold dollars" (9:42). With this level of interest and philosophy towards creating joint communications-computer systems, the authors need to ensure the book adequately addresses joint systems. For joint tactical systems, Handouts KIS 4911-556C and 556A prepared by 3390 TTG state, "...advanced theoretical concepts of switching systems networks, manual and electromechanical switches, control and operations of electronic digital switches, and network control of both theater-fixed and tactical switched networks" (33:ii; 37:ii). An easy approach for 49XX officers to use is to discuss the communications-computer systems under each unified and specified command.

COMBINED SYSTEMS

Combined systems, the sixth type, would include systems that are operated and maintained with NATO, US Forces Korea, and US Forces Japan to name a few. The authors must consider the dynamic environment of these combined communications-computer systems. For example, a case can be made that NATO may want to capitalize on C3I advancing technologies to make battle simulation and exercises more realistic (29:--). The political, military, and economic environments support this position. Politically, the tendency is to reduce nuclear weapons as evidenced by the recently signed intermediate nuclear forces (INF) agreements. To maintain the same level of deterrence, conventional forces will become more important (12:--). With decreasing budgets, economic conditions will make it difficult for the NATO governments to increase the size of the forces. Militarily, exercises have increased. For example, Red Flag has grown from 522 training sorties in 1975 to over 217,000 in 1987 (14:80,81). The new computer monitoring system, Red Flag Mission and Debriefing Systems (RFMDS), has four times the capacity of an earlier system (20:84). Thus, the authors need to consider the political, military, and economic environments in determining which topics to emphasize.

BLACK PROGRAM SYSTEMS

The last type of communications-computer systems that must be included is the black program systems. To include these systems, the authors will be tempted to make the book classified. This would restrict access to the book and should not be done. AF/INX does publish a classified Air Force intelligence communications-computer plan. The authors should review this plan as a great deal of the information is unclassified and can be included in the book. Recommendations in this chapter, as well as the other chapters, are summarized in the next chapter.

Chapter Five

RECOMMENDATIONS

1. The authors should tailor the book for 49XX officers. They should use Air Force communications-computer systems to help explain basic principles and then refer to these principles when explaining the systems. In other words, it should not be like a textbook that is written for a generic group of people.

2. Maximum use of graphs, charts, pictures, figures, and checklists should be made for two reasons. First, they will save space - "picture worth a thousand words." Second, the 49XX officers will be able to grasp the information quicker than reading detailed descriptions.

3. The information on topics should be proportional to the number of 49XX officers who will use it. For example, the section on microcomputers should be larger than the section on supercomputers.

4. Information in the book should focus on the present and future as opposed to the past. In other words, current issues such as proliferation of micros are more important than the history of micro development.

5. Conclusions of relative research projects completed by AU students should be included. These reports will save the authors of the book numerous hours of research and provide the 49XX officers sources to find the details if more information is required.

6. The space devoted to a topic must be proportional to its future application. For example, the section on Ada, a DOD developed computer language that will be the most important programming language of the 1980's and 1990's, should be longer than the sections on other languages.

7. Analyses from magazines and newspapers should be included in the book. Many of these, such as the one mentioned in Chapter Two on comparing processing software with macro-capabilites, can save 49XX officers hours of research.

8. Each section of the book should identify the Air Force experts for that particular area. In the case of Air Force programmers, it would be helpful for 49XX officers to know where the expert programmers are located for specific types of communications-computer requirements.

9. The authors should review all AIC publications prepared for 49XX courses and integrate these into the book. Some of these publications will contain extensive information that should be included while others should only be referenced.

10. The book should contain refresher information on the topics taught in USAF formal 49XX courses. This information should be direct and to the point. It should not contain the level of detail as contained in 3390 ITG student text.

11. Color figures should be used in the book. This will make it easier for the 49XX officers to grasp the information.

12. Recent changes in communications-computer area at DOD and HQ USAF level should be considered in the structure of the book. As discussed in this paper, a merger of COMSEC and COMPUSEC at DOD level may be a good format for the book.

13. The structure of AWC and ACSC curriculum should be used as an input in determining the structure of the book. The curriculum of these two schools are adjusted each year to meet the needs of the student and the Air Force. These changes may also be applicable to the book.

14. The book should be structured by unified, specified, or MAJCOM on certain topics. This will allow the officers in these organizations to quickly identify the material that directly affects them.

15. The authors should include only communications-computer systems that have been funded. Too many programs are changed before they are funded. The book does not have the space for those systems.

16. Cost data should be included on items or systems being compared. With all government acquisitions, cost is a primary consideration.

17. The political, military and economic environments must be considered when deciding which topics to emphasize in the book. As discussed, communications-computer systems that support exercises may become more important to meet USAF training needs. The authors would not know this unless they gathered data in all three environments.

BIBLIOGRAPHY

A. REFERENCES CITED

Books

1. Bartee, Thomas C. (Ed.). Data Communications, Networks, and Systems. Indianapolis, IN: Howard W. Sams & Co., 1984.

2. Deasington, R. J. A Practical Guide to Computer Communications and Networking. New York: Ellis Horwood Limited, 1984.

3. Long, Larry. Introduction to Computers and Information Processing. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1984.

4. Martin, James. Telecommunications and the Computer. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976.

5. Pooch, Udo W., William H. Greene, and Gary G. Moss. Telecommunications and Networking. Boston: Little, Brown and Company, 1983.

6. Rosenau, Milton D. Jr., and Marsha D. Lewin. Software Project Management. London: Lifetime Learning Publications, 1984.

7. Sanders, Donald H. Computers Today. New York: McGraw-Hill Book Company, 1985.

Articles and Periodicals

8. Avery, Mark R., Capt, USAF. "A Working Local Area Network." SIGNAL, Vol. 42, No. 1 (September 1987), pp. 111-116.

9. Cannan, James W. "Can TRANSCOM Deliver?" Air Force Magazine, Vol. 70, No. 10 (October 1987), pp. 40-46.

10. Cannan, James W. "Steady Steps in Strategic C3I." Air Force Magazine, Vol. 70, No. 6 (June 1987), pp. 44-50.

11. Chain, John T., Gen, USAF. "SAC and C3I." SIGNAL, Vol. 41, No. 12 (August 1987), pp. 26-31.

12. Correll, John T. "Why NATO Needs a Conventional Defense." Air Force Magazine, Vol. 70, No. 8 (August 1987), pp. 38-46.

13. Cotter, George R. and Jack Bond. "Software Acquisition." SIGNAL, Vol. 41, No. 8 (April 1987), pp. 76-83.

14. Johnson, Quinn G. "Range Wars." Air Force Magazine, Vol. 70, No. 12 (December 1987), pp. 78-85.

15. Kelley, William D., LTCmdr, USN. "High Frequency Communications: New Life for an Old Friend." SIGNAL, Vol. 41, No. 12 (August 1987), pp. 89-94.

16. Latham, Donald C. "Security in the Information Age." SIGNAL, Vol. 41, No. 9 (May 1987), pp. 173-180.

17. Lorenz, Susan. "Ada Shock: A Computer Cultural Transition." SIGNAL, Vol. 41, No. 9 (May 1987), pp. 147-156.

18. Ludwig, Robert H., Brig Gen, USAF. "Interesting Times." SIGNAL, Vol. 41, No. 9 (May 1987), p. 48.

19. Marcus, Daniel J. "Project Bold Stroke." SIGNAL, Vol. 40, No. 8 (April 1986), pp. 100-101.

20. Milton, T. R., Gen, USAF (Ret.). "Nellis and the Art of Airpower." Air Force Magazine, Vol. 70, No. 7 (July 1987), pp. 80-85.

21. Morger, Randal E., Maj, USAF. "New Accents on PME." Air Force Magazine, Vol. 70, No. 12 (December 1987), pp. 62-66.

22. Piotrowski, John L., Gen, USAF. "C3I for Space Control." SIGNAL, Vol. 41, No. 10 (June 1987), pp. 23-33.

23. Prather, Gerald L., Maj Gen, USAF. "Organizing for the Future." SIGNAL, Vol. 37, No. 11 (July 1983), pp. 33-35.

24. Stihl, John T., Maj Gen, USAF, and Lt Col Lawrence J. Cahill, USAF. "Professional Development Center Program." SIGNAL, Vol. 40, No. 7 (March 1986), p. 95.

25. Stinson, David R., Maj, USAF. "Air Force Communications Computer Systems Architecture." SIGNAL, Vol. 41, No. 12 (August 1987), pp. 69-73.

26. Symposiums and Conferences Advertisements. SIGNAL, Vol. 42, No. 4 (December 1987), pp. 77-82, 116, 117, 119, 121, 123, 126.

27. Technical Education Courses Advertisement. SIGNAL, Vol. 42, No. 4 (December 1987), p. 94.

28. Webster, John. "Macros Offer Solution to Word-Processing Drudgery." PCWEEK, Vol. 4, No. 6 (17 November 1987), pp. 69, 75, 78, 80.

29. Wickham, John A. Jr., Gen, USA (Ret). "Deterrence, Force Readiness, and C3I." SIGNAL, Vol. 42, No. 4 (December 1987), pp. 15-16.

Official Documents

30. Air Training Command. Handout KIS 4911-508A: Transmission Media. Keesler AFB, MS: 3390 Technical Training Group, March 1987.

31. Air Training Command. Handout KIS 4911-510E: Selected Readings in Analog and Digital Theory. Keesler AFB, MS: 3390 Technical Training Group, April 1987.

32. Air Training Command. Handout KIS 4911-520B: Radio Communications Technology. Keesler AFB, MS: 3390 Technical Training Group, March 1987.

33. Air Training Command. Handout KIS 4911-556C. Tactical Automated Communications Networks SOC 556. Keelser AFB, MS: 3390 Technical Training Group, October 1986.

34. Air Training Command. Student Text KIS 4911-510A: Principles and Concepts of Analog Communications Theory. Keesler AFB, MS: 3390 Technical Training Group, October 1986.

35. Air Training Command. Student Text KIS 4911-530A: Light, Lasers, and Fiber Optics. Keesler AFB, MS: 3390 Technical Training Group, March 1987.

36. Air Training Command. Student Text KIS 4911-556B: Space Division Telephone Switching Systems. Keesler AFB, MS: 3390 Technical Training Group, May 1986.

37. Air Training Command. Study Guide KIS 4911-556A: Switching System Engineering and Network Control. Keesler AFB, MS: 3390 Technical Training Group, September 1986.

38. Headquarters US Air Force. AF Phamphlet 700-49: Communications-Computer Systems Officer Career Development Guide. Washington, DC: HQ USAF/SCBH, 30 December 1986.

39. Headquarters US Air Force. AF Regulation 50-5: USAF Formal Schools. Washington, DC: HQ USAF/DPPES, 1 September 1987.

Unpublished Materials

40. Abel, James M., Maj, USAF. "Alternatives To Implement Information Systems." Research Study at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 1987.

41. Brown, Robert D., Maj, USAF. "History of Tactical Satellite Communications From 1965-1986." Research study prepared at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 1987.

42. Gatewood, James D., Maj, USAF. "Standard Base Level Computer System Access." Research study prepared at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 1987.

43. Landry, Jerry, Col, USAF. "Headquarters Standard Systems Center." HQ SSC/CC Briefing Charts CC 870353.

44. Mull, Rick, Maj, USAF. "Defense Data Network Program - DDN." HQ SSC/AQFCD Briefing Charts 408-S, March 1987.

45. Ritter, Richard A., Maj, USAF. "A Generic Model for a Base-Level Information Transfer Network." Research study prepared at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 1984.

46. Severson, Terrance E., Lt Col, USAF. "Air Force Information Systems - the Beginning." Research Study prepared at the Air War College, Air University, Maxwell Air Force Base, Alabama, 1985.

47. Taylor, David A., Maj, USAF. "The Software Crisis and a Senior Leaders Awareness Course." Research study prepared at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 1987.

48. Tipps, Jerry W. "Fiber-Optics Application for High-Speed (400 Million Bits Per Second) Data Communication System." Research study prepared at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 1987.

Other Sources

49. Tackett, Buford D., Maj, USAF. AUCPD/IM, Maxwell Air Force Base, Alabama. Interview, 18 November 1987.

B. RELATED SOURCES

Books

Ein-Dor, Phillip and Carl R. Jones. Information Systems Management: Analytical Tools and Techniques. New York: Elsevier Science Publishing Co. Inc., 1985.

Martin, James. Introduction to Teleprocessing. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972.

Willcox, A. M., M. G. Slade, and P. A. Ramsdale. Command, Control and Communications (C3). Brassey's Defence Publishers, 1983.

Articles and Periodicals

Ballard, Colleen A. "Team of the Year." Air Force Magazine, Vol. 70, No. 9 (September 1987), p. 100.

Paige, Emmett Jr., Lt Gen, USA. "The Army Looks at Fiber Optics." SIGNAL, Vol. 41, No. 10 (June 1987), pp. 41-43.

Perl, Joseph M., Dr., "A Real HF Adaptive Communications System." SIGNAL, Vol. 41, No. 12 (August 1987), pp. 55-59.

Toone, Joseph W. and Susan Titmas. "Introduction to JTIDS." SIGNAL, Vol. 41, No. 12 (August 1987), pp. 55-59.

Official Documents

Air Training Command. Handout KIS 4911-510C: Analog Communications Theory. Keesler AFB, MS: 3390 Technical Training Group, March 1987.

Air Training Command. Handout KIS 4911-530B: Copy of Transparencies - Optical Fibers. Keesler AFB, MS: 3390 Technical Training Group, no date.

APPENDIX

BOOK OUTLINE

I. Introduction
   A. Existing Professional Development
   B. Purpose of Book
   C. Overview

II. Computers
   A. Hardware
      1. Introduction
      2. Components
      3. Micros
      4. Supermicros
      5. Minicomputers
      6. Mainframes
      7. Supercomputers
      8. Issues

   B. Software
      1. Introduction
      2. Computer Languages
      3. Systems Software
      4. Applications Software
      5. Software Development
      6. Commercial Software
      7. Issues

III. Communications
   A. Basic Technical Communications Information
      1. Time/frequency/bandwidth Relationship
      2. Error Control
      3. Modulation
      4. Multiplexing
      5. Analog/Digital
      6. Protocols
      7. Switching
      8. Security

B. Transmission Media
   1. Paired Cable
   2. Coaxial Cable
   3. Waveguides
   4. Optical Fibers
   5. Radio Propagation

IV. Systems
   A. Functional Standard Systems
   B. MAJCOM Unique Systems
   C. Common User Systems
   D. Weapon System Embedded Systems
   E. Joint Systems
   F. Combined Systems
   G. Black Program Systems

Appendix: Existing Professional Development

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